AFRL-HE-WP-TR-2007-0047

Digital Integrated Collection Environment (DICE)/Cognitive Reasoning Engine (CORE) Intelligent Threat Architecture Study

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May 2003

Interim Report for March 2002 – May 2003

Air Force Research Laboratory
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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
May 2003	Interim	March 2002 - May 2003

4. TITLE AND SUBTITLE
Digital Integrated Collection Environment (DICE)/Cognitive Reasoning Engine (CORE) Intelligent Threat Architecture Study

5a. CONTRACT NUMBER
DAAH01-00-D-A100/15

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
63832D

6. AUTHOR(S)
Kenneth Detulio, David Skipper

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER
0476DM00

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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8. PERFORMING ORGANIZATION REPORT NUMBER

BRC-FR-00490-03-013

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Materiel Command
Air Force Research Laboratory
Human Effectiveness Directorate
Warfighter Interface Division
Cognitive Systems Branch
Wright-Patterson AFB OH 45433-7604

Defense Modeling and Simulation Office
1901 N. Beauregard Street, Suite 500
Alexandria VA 22311-1705

10. SPONSOR/MONITOR'S ACRONYM(S)
AFRL/HECS, DMSO

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

AFRL-HE-WP-TR-2007-0047

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.
AFRL/PA cleared on 28 June 2007, AFRL-WS-07-1549.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report provides a brief explanation of a project whose original objective was to develop an intelligent entity to enhance the capabilities of the Digital Integrated Air Defense System (DIADS) system. The intent was to develop an overall architecture that would provide basic intelligence and the framework to extend the entities in the future to even greater levels of intelligence. Due to unexpected issues with the use of DIADS, the decision was made to switch the focus of this effort from DIADS to the Digital Integrated Collection Environment (DICE) simulation. From that point, the project was to determine the BRC developed Cognitive Reasoning Engine (CORE) compatibility with the DICE system. This compatibility was accomplished and the final result is that the DICE simulation can accept external control of entities to provide more robust human behavior representation.

15. SUBJECT TERMS Human Behavior Modeling, Cognitive Reasoning Engine (CORE), Digital Integrated Air Defense System (DIADS), Digital Integrated Collection Environment (DICE)

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			John L. Camp
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR	16	19b. TELEPHONE NUMBER *(include area code)*

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Abstract

This project was to determine CORE compatibility with the DICE system. This was accomplished by using a DICE system provided at the TSMO facility. The first step was to get the system to execute using system "canned" test sets. Once this was accomplished the CORE PDU link was established and controllability by CORE shown.

Section

1.

Introduction

Description of the Project

1.1 Purpose

The original objective of this project was to develop an intelligent entity to enhance the capabilities of the current Digital Integrated Air Defense System (DIADS) system. The intent was to develop an overall architecture that would provide basic intelligence and the framework to extend the entities in the future to even greater levels of intelligence. Midway through the project, the Government made a decision to switch the focus of the effort from DIADS to the Digital Integrated Collection Environment (DICE) simulation.

1.2 History

As discussed in the initial project plan [1], this project began as the DIADS project. DIADS is an Air Force simulation primarily supported out of the 412th Test Wing at Edwards AFB, California. The human behavioral modeling group at the Defense Modeling and Simulation Office (DMSO) was the original proponent of the effort and brought BRC and the DIADS test support group together to try to solve inherent deficiencies within the human behavioral components within DIADS. After the project was started, Air Force representatives decided that this project could not be supported by their local technical support and therefore directed that the technical effort cease for re-evaluation. Fortunately the Air Force Air Intelligence Agency (AIA) in San Antonio, Texas dealt with a different simulation, DICE and had similar needs for intelligent remote control of entities to support testing, training. Therefore after some delays due to shutdown and restart of the effort, a new set of goals was prepared and the project re-directed. This change in technical goals also obviated the need for a DIADS Interface design and a DIADS acceptance test. Therefore this report focuses on the lesser goals described in following sections.

Because of the change in simulations and the substantial impacts of shutdown directives and restart objectives the project was to focus on assessing whether the DICE simulation could serve as a substitute for the DIADS system. For that purpose, the government provided a version of the DICE system for evaluation in the government facilities at the Threat Systems Management Office (TSMO) in Redstone Arsenal, Alabama. This report reflects the findings of that second phase, the evaluation of the provided copy of DICE.

1.3 Goals and Objectives

The original job consisted of four major components:

- Develop an entity
- Acquire the knowledge for the entity
- Develop a standardized interface to the DIADS system
- Demonstrate use in a realistic test

The revised set of goals for DICE were:

- Determine if the DICE simulation could accept external control of entities
- If DICE can accept external controls, determine if the Cognitive Reasoning Engine (CORE) can provide that control

Section

2.

Discussion

Discussion of the Technology

2.1 Technical Approach

2.1.1 Procedures

After setting up the initial project objectives, the project was revised to fit new goals well after the start of the project. The revised intent of this project was to provide simulation of the command elements of a lay-down of SA-15 systems in the DICE Simulation. Discussions with the developers of the simulation revealed that DICE was intended to have existing functionality that would allow for the control of any fire unit by an external source. This was originally meant to allow control of entities with the DIADS. However they also disclosed that this functionality was completed, but it had never been actually run in a real situation with an external simulation. Further, BRC also found out that the version of DICE installed for at the Threat Systems Management Office (TSMO) was not configured properly for use of these messaging schemes. Because of this, and the fact that the version of DICE is now superseded and outdated, BRC encountered significant difficulty getting even the "canned" test cases provided by the developer to execute on a system that the developer installed and certified. Eventually, after the developer debugged the system, the test cases ran and BRC could focus on the control messages and assume that the control was working. The basic set of PDU messages provided the test basis for determining if this system was CORE compatible. The CORE component of this project required that actors for PDU interaction and the graphs for ADA behavior be updated, integrated and testes with the latest version of CORE. Details of this can be found in the documentation of the CORE PDU Actor and the behavior graphs included with it.

Testing these behaviors with DICE has been delayed due to issues, as discussed above, with the setup that was provided us by the Air Force Air Intelligence Agency (AFAIA). Although it was originally thought that the TSMO DICE machine was setup to communicate using these messages

there were a number of things that had to be reconfigured and several scenarios setups were tried. Procedures for setup of these messages can be obtained from DICE Documentation. For the purpose of testing or a demonstration, the BRC Run script should now be used to start DICE (It can be found in the same directory as the run-all script described in DICE Documentation). In order to verify operation, choose the BRC Test Scenario from the load menu. The CORE Component can be started either before or after, but no messages will be sent until the weapon post simulated by CORE is up. After starting all components select the air base in DICE, choose an aircraft and task it to fly over the units controlled by CORE. The command messages can be seen using the utilities described below, or watching CORE for feedback.

2.1.2 Equipment

In addition to the AFAIA supplied SGI with Irix 6.5 running DICE 2.0 CORE was tested on a Power Edge Server with Red Hat Linux 7.1 and a Windows NT4 machine to access DICE documentation. CORE development and the implementation of the message set in CORE was done on a Dell Workstation with Gentoo Linux 1.4rc4 and an AMD Dual Processor server using Red Hat 7.3. For a list of Platforms capable of running the CORE component see the CORE documentation.

2.1.3 Facilities

Most development was done at BRC's offices. Testing of DICE and the configuration of DICE was performed in TSMO lab facilities due to classification of the DICE machine.

2.1.4 Data

All behavior algorithms used were developed in previous CORE Applications so no special data was required for this project.

2.1.5 Computation

There were no extreme processing requirements for this project outside of those required by DICE.

2.2 Results

The expected result at the outset of this re-directed task was that this was a straightforward demonstration of CORE compatibility. Due to the installation and configuration problems that had to be overcome prior to any test work, the actual tests were abbreviated, but sufficient to show the compatibility of this version. Unfortunately the older version may not be

supported. Further, the new version does not have the same external connections as the older DICE system. Proof of that systems compatibility is another issue due to the changes in the system.

Section

3.

Documentation

Supporting Documentation Submittals

[1] Skipper, David (2002). *DIADS II Project Plan CORE Intelligent Threat Architecture.* BRC- PP-00490-03-012, Bevilacqua Research Corporation.

Section

4.

Accomplishments

Status Overview

4.1 Accomplishments

DMSO's original purpose was to provide seed funding to enhance a simulation that was widely used within the joint services. Despite the radical changes in the direction of the program at the request of the Air Force, BRC was able to run and connect to the DICE simulation and supply controlling commands. Also in spite of the Air Force's inability to support the DIADS work, we were able to show, through analysis, that the CORE entities would have significantly enhanced the ability of DIADS to represent intelligent active threat systems during operational testing.

4.2 Change Proposals

After evaluating the provided DICE system, it was clear that changes to the setup procedures by the developer will be necessary. Further the use of a newer version of DICE may become an issue that needs to be resolved early.

Section

5.

Summary

Report Summary

This project was to determine CORE compatibility with the DICE system. This was accomplished by using a DICE system provided at the TSMO facility. The first step was to get the system to execute using system "canned" test sets. Once this was accomplished the CORE PDU link was established and controllability by CORE shown. BRC and TSMO will demonstrate the ability of CORE entities to be used within DICE to the Air Force Intelligence Agency sometime in late FY'03. We believe that the new capability that this effort created for DICE will result in further work to create intelligent threat entities for DICE being funded by AIA.

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Section

6.

Conclusion

Findings

BRC can from the test execute conclude that the version of DICE operating at the TSMO facility in Redstone Arsenal, Alabama is compatible with CORE through a PDU connection. Further, the use of the external connection with this version permits, within the simulation limits, the control of simple SA15 units. This opens the door for the use of intelligent entities within DICE.

Section

7.

Recommendations

Suggested Improvements

Due to the extraordinary difficulties in the overall program and the DICE setup in particular, it is recommended that consideration be given to changing DICE versions to a newer version.

Section

8.

Abbreviations

Symbols, Glossary and Acronyms

Acronym	Definition
ADA	Air Defense Artillery
AFAIA	Air Force Air Intelligence Agency
BRC	Bevilacqua Research Corporation
CORE	Cognitive Object Reasoning Engine
DIADS	Digital Integrated Air Defense System
DICE	Digital Integrated Collection Environment
NT	New Technology
PDU	Program Data Unit
SGI	Silicon Graphics Incorporated
TSMO	Threat Systems Management Office